Claims:

1. An active power filter apparatus with a reduced VA rating for reducing harmonic currents generated in a neutral line connected between a load and a three-phase AC power source in a three-phase four-line power distribution system, the apparatus comprising:

an inverter unit connected in series with the neutral line for controlling current flow of the neutral line based on a predetermined voltage control signal so that a fundamental component of a load-side neutral current flows to the three-phase AC power source and a harmonic component of the load-side neutral current is circulated to the load;

a transformer connected between the neutral line and each phase line of the three-phase AC power source for forming a current path which allows the harmonic component of the load-side neutral current to flow to the load through the phase line;

a rectifier unit connected between the transformer and the inverter unit for rectifying a predetermined drive voltage, supplied to the transformer, into a DC voltage and applying the rectified DC voltage to the inverter unit; and

a controller for generating the voltage control signal for use in controlling a PWM operation of the inverter unit based on a first small signal of the load-side neutral current

and a second small signal of the power-source-side neutral current, which are extracted from the neutral line.

2. The apparatus as set forth in claim 1, wherein the transformer includes first to third coil sections, a neutral point of the first to third sections being connected to the neutral line, each output terminal of the first to third coil sections being connected to each corresponding phase line, a center tap having a predetermined division ratio being formed between the neutral point and each output terminal and being connected to a corresponding input terminal of the rectifier unit.

3. The apparatus as set forth in claim 2, wherein each center tap is formed at a position where a division ratio of an upper coil to a lower coil in each of the first to third coil sections is 1-X : X, said X being equal to or less than 0.5.

4. The apparatus as set forth in claim 1, wherein the transformer is a Δ-Y transformer.

5. The apparatus as set forth in claim 1, wherein a first current sensor for extracting the first small signal from the load-side neutral current and a second current sensor for extracting the second small signal from the power-source-side

current are connected in series on the neutral line, and

wherein the controller receives the first and second small signal from the first and second current sensors.

6. The apparatus as set forth in claim 1, wherein the inverter includes:

a smoothing capacitor for charging itself with a predetermined DC drive power received through the rectifier;

a single-phase full-wave inverter circuit for performing a PWM operation according to the voltage control signal provided from the controller so as to perform a current-flow switching control so that the harmonic component of the load-side neutral current is circulated to the load through the transformer;

a ripple-removing inductor connected to the output terminal of the single-phase full-wave inverter circuit for removing a switching ripple; and

a bypass switch which is switched off during a normal operation of the single-phase full-wave inverter circuit and switched on according to a predetermined control signal provided from the controller when a malfunction of the single-phase full-wave inverter circuit occurs.

7. The apparatus as set forth in claim 1, wherein the inverter unit is a single-phase half-wave inverter.